Amendments to the Drawings:

Applicants have included a replacement drawing sheet for amended Figure 6 with this response. In amended Figure 6, the "side view" has been deleted.

Attachment: Replacement Sheet

Annotated Sheet Showing Changes

REMARKS/ARGUMENTS

Claims 1-13, 18, and 21 are pending in the present application. Claims 1-2, 6, 8, 11-13, 18, and 21 are amended to place the claims back into the same condition as those claims were originally presented upon filing of the application and to correct typographical errors. The claims were also amended to address the rejections under 35 U.S.C. § 112, second paragraph in the non-final office action of July 5, 2005. Support for these amendments can be found in the claims as originally filed and in the specification on page 11, line 24 through page 12, line 7. Claims 22-24 are added. Support for claims 22-24 can be found in Figure 6 and in the specification at page 13, line 28 through page 14, line 15. No new matter has been added. Reconsideration of the claims is respectfully requested.

Also, Applicants have submitted a replacement drawings sheet for the original drawing sheet showing Figure 5 and Figure 6. The "side view" shown in Figure 6 has been deleted. These changes will be incorporated into a formal set of drawings upon approval of the proposed changes by the examiner. No new matter has been added.

I. Objection to the Drawings

The examiner objects to Figure 6 as follows:

> Figure 6 is objected to as being unclear. In one aspect of Figure 6, it appears that the permanent magnet (*element 640*) is adjacent the sides of the MR element (*element 620*), but part of the element extends above (or below?) the permanent magnet (*elements 610*). Yet the apparent "side view" included in Figure 6 shows the permanent magnet stopping at the base of the MR element and not extending adjacent to it, much less on top or bottom of it. It appears that at least one aspect of this drawing is incorrect. Applicants are reminded that any correction to the Figure must have support in the as-filed disclosure or it will be considered as new matter.

Final Office Action of December 12, 2005, p. 2.

Applicants have included a replacement drawing sheet for amended Figure 6 with this response. In amended Figure 6, the "side view" has been deleted. However, Figure 6 fully and adequately describes the overall structure of the magnetic sensor shown, and also fully and adequately supports the claims when viewed in conjunction with the description provided on page 13, line 28 through page 14, line 15 of the specification. Thus, objection to Figure 6 is now

moot. No new matter has been added.

II. Asserted Rejection Under 35 U.S.C. § 112, First Paragraph

The examiner rejects claims 1, 2, 11-13, 18, and 21 under 35 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement. Applicants have amended these claims such that they are similar to the originally-filed claims, thereby rendering the rejection moot. These claims are different from the claims as originally filed only in that the current amendments to these claims address the rejection under 35 U.S.C. § 112, second paragraph presented in the non-final office action of July 5, 2005. Support for these amendment scan be found in the claims as originally filed and in the specification on page 11, line 24 through page 12, line 7.

III. Asserted Rejection Under 35 U.S.C. § 112, Second Paragraph

In the first, non-final office action of July 5, 2005, the examiner rejected claims 1, 6, 11, and 16 as indefinite due to lack of antecedent basis for terms described by the examiner. Claim 16 has been canceled. The remaining claims have been amended accordingly in this response. . Support for these amendment scan be found in the claims as originally filed and in the specification on page 11, line 24 through page 12, line 7. Therefore, the rejection under 35 U.S.C. § 112, second paragraph has been overcome.

IV. 35 U.S.C. § 102, Asserted Anticipation by Hasegawa

The examiner rejects claims 1-12 and 18 as anticipated by *Hasegawa* et al., Magnetic Sensor Having Free Layer Additionally Provided with Magnetic Anisotropy by Shape Anisotropy, U.S. Patent Application Publication 2004/0067389, April 8, 2004 (hereinafter "*Hasegawa*"). This rejection is respectfully traversed.

The examiner rejected the claims as amended, and the claims as originally filed, as anticipated by Hasegawa. The rejections stated in the final office action are moot in the light of the amendments to the claims in this response, except for those portions of the rejection that that correspond to the originally presented rejection. Therefore, Applicants address the rejection as originally presented in the non-final office action of July 5, 2005.

In the non-final office action of July 5, 2005 the examiner states:

> Regarding claims 1 and 11, *Hasegawa* et al. disclose a MR sensor (Title) comprising a plurality of sensor stack layers (Figure 2); and at least one depression (i.e. applicants' "stabilizer depression") formed in one sensor stack layer within the plurality of sensor stack layers (Figure 2, area marked as C(Tw)).
>
> The limitation "wherein the at least one stabilizer depression imparts a restorative force on a magnetic field of a free layer of the magnetoresistive sensor to align the magnetic field with a bias direction" is a functional limitation(s). As defined in the MPEP, "[a] functional limitation is an attempt to define something by what it does, rather than by what it is (eg., as evidenced by its specific structure or specific ingredients). There is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper. In re Swinehart, 439 F.2d 210, 169 USPQ 226 (CCPA 1971)"— MPEP § 2 173.05(g). However, the examiner notes that "where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on" (emphasis added) - MPEP § 2183.
>
> *In the instant case, the claimed limitation(s) "wherein the at least one stabilizer depression ... with a bias direction" is a functional limitation(s) and is deemed to be an inherent characteristic of the prior art since the prior art is substantially identical in composition and/or structure.* The examiner's sound basis for this assertion is that the depression formed by *Hasegawa* et al. is specifically to influence the biasing ability of the sensor (Paragraphs 0025 — 0033 and 0103 — 0106).

Office action of July 5, 2005, pp. 7-8 (emphasis added).

A prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. *In re Bond*, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). All limitations of the claimed invention must be considered when determining patentability. *In re Lowry*, 32 F.3d 1579, 1582, 32 U.S.P.Q.2d 1031, 1034 (Fed. Cir. 1994). Anticipation focuses on whether a claim reads on the product or process a prior art reference discloses, not on what the reference broadly teaches. *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983). In this case each and every feature of the presently claimed invention is not identically shown in the cited reference, arranged as they are in the claims.

Applicants first address the rejection of claim 1. Claim 1 as amended is as follows:

> 1. A magnetoresistive sensor, comprising:

a plurality of sensor stack layers, wherein a layer in the plurality of sensor stack layers is a free layer; and

at least one stabilizer depression formed in one sensor stack layer within the plurality of sensor stack layers, wherein the at least one stabilizer depression imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction.

Regarding claims 1 and 11 as amended, *Hasegawa* does not anticipate claims 1 and 11 because *Hasegawa* because the claimed feature that "at least one stabilizer depression imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction" is not an inherent characteristic of the prior art, as asserted by the examiner. Figure 2 of *Hasegawa*, cited by the examiner, is as follows:

FIG. 2

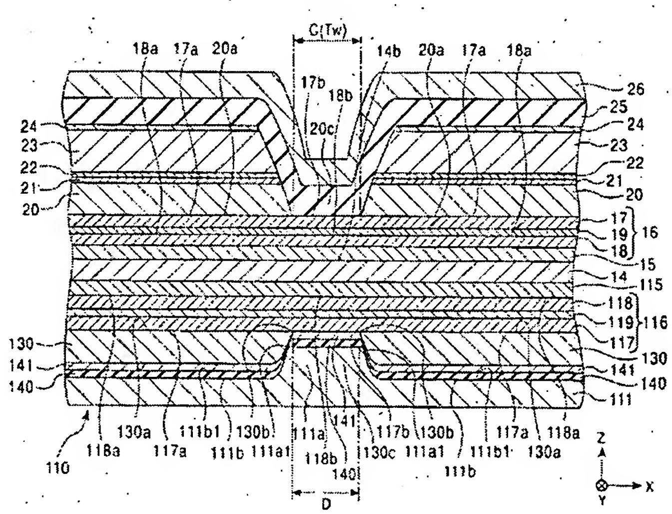

Figure 2 of *Hasegawa* shows a spin valve sensor made of layers 116 (second fixed magnetic layer), 115 (non-magnetic layer), 14 (free layer), 15 (non-magnetic layer), and 16 (first fixed magnetic layer). The other layers are not part of the spin valve sensor. Below the spin valve sensor, layer 130 is an antiferromagnetic layer, layer 141 is the seed layer, layer 140 is a lower gap layer, and layer 111 is the lower shield layer. Above the spin valve sensor, layer 20 is an antiferromagnetic layer, layer 21 is the stop layer, layer 22 is a protection layer, layer 23 is an electrode layer, layer 24 is a protection layer, layer 25 is an upper gap layer, and layer 26 is the upper shield layer.

The depression shown in Hasegawa is used to define a physical structure to provide narrower shield-to-shield gaps. In fact, Hasegawa's disclosure is directed to a technique to

controllably decrease the shield-to-shield spacing, or gaps, at the functional gap width, where the sensor is. Thus, the gaps shown in Hasegawa lie directly along and parallel to the tracks of any magnetic media that Hasegawa's sensor reads, because the direction of magnetization of the free magnetic layer is *oriented in the track width direction*. For this reason, the depressions shown in Hasegawa *do not and cannot* impart a restorative force on a magnetic field of the *free layer* of the magnetoresistive sensor to align the magnetic field with a bias direction, as provided in claim 1. For example, Hasegawa specifically provides that:

> An intermediate region is formed at a central portion of an element in a track width direction, and an antiferromagnetic layer is not provided at the intermediate region. Accordingly, a sense current can be prevented from being shunted to the intermediate region, and as a result, improvement in reproduction output and strength against magnetic electrostatic damage can be realized. In addition, since the thickness of the central portion of the element is decreased, trend toward narrower gap can be realized. *Furthermore, since the direction of magnetization of a free magnetic layer is oriented in the track width direction by shape anisotropy, means for orienting the magnetization is not necessary, and hence the structure and manufacturing method of the element can be simplified.*

Hasegawa, Abstract (emphasis added).

Hasegawa therefore provides that the depressions in Hasegawa influence the biasing ability of the sensor by changing the pinned layer biasing technique. Hasegawa changes the pinned layer biasing by removing the antiferromagnet in the vicinity of the read track. Hasegawa therefore relies on the exchange coupling of the pinned synthetic antiferromagnetic material of fixed magnetic layer 16 to hold the pinned layer fixed. In other words, Hasegawa relies on the magnetic exchange interaction phenomena to achieve the effect of his invention; which is to decrease the shield-to-shield gaps at the functional gap width.

In contrast, the claimed invention contains the feature that "at least one stabilizer depression imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction." Thus, claim 1 requires that the stabilizer depression impart a restorative force on a magnetic field of the *free layer*. Similarly, the magnetic field *of the free layer* is provided with a bias direction. As shown above, Hasegawa instead uses depressions to affect the magnetic field of the *pinned layer*, and these depressions are incapable of affect the magnetic field of the *free layer* because the depressions in Hasegawa have an orientation that results in the depressions being incapable of achieving the claimed

features.

By way of counter-example, for the depressions in Hasegawa to affect the free layer in the claimed manner, the depressions would have to be oriented perpendicular to the orientation disclosed in Hasegawa. However, Hasegawa does not teach any orientation for the depressions shown in Hasegawa, except for the orientation described above. For this reason, Hasegawa does not teach structures or compositions that are substantially identical to those presented in claim 1. Therefore, Hasegawa does not teach all of the features of claim 1.

Nevertheless, the examiner asserts that the structures shown in Hasegawa have inherent characteristics that read on the features of claim 1. For example, the examiner refers to the following portion of Hasegawa for this proposition:

> [0025] In the case described above, since the nonmagnetic metal layer, which is provided at the intermediate region and has the same composition as that of the antiferromagnetic layer, has a very small thickness so as to have an irregular crystal structure that cannot exhibit antiferromagnetic properties, the loss of the magnetoresistive effect caused by the shunt of sense current described above can be decreased. In addition, since the nonmagnetic metal layer at the intermediate region has no antiferromagnetic properties, the exchange coupling with the fixed magnetic layer is not substantially generated, and as a result, the magnetization of the fixed magnetic layer will not become unstable at a high temperature.
>
> [0026] In addition, according to the present invention, the crystal of the nonmagnetic metal layer and the fixed magnetic layer at the intermediate region are preferably placed in an epitaxial or a heteroepitaxial state, and the fixed magnetic layer preferably has an open end surface at a face opposing a recording medium.
>
> [0027] It is preferable that the magnetization of part of the fixed magnetic layer facing the nonmagnetic metal layer in the thickness direction be also fixed tightly by uniaxial anisotropy of the fixed magnetic layer itself.
>
> [0028] As factors determining the magnetic anisotropic magnetic field of a ferromagnetic layer, for example, there may be mentioned crystal magnetic anisotropy, induced magnetic anisotropy, and a magnetoelastic effect. Among those mentioned above, in a film having a polycrystalline structure in which crystal grains are randomly oriented, it is difficult to obtain uniaxial anisotropy by the crystal magnetic anisotropy. On the other hand, when a magnetic field is applied to a film in one direction when it is formed or is processed by heat treatment, uniaxial anisotropy resulting from the induced magnetic anisotropy is obtained, and when a uniaxial

> stress is applied, due to the magnetoelastic effect, uniaxial anisotropy is obtained.
>
> [0029] Of the induced magnetic anisotropy and the magnetoelastic effect, which determines the uniaxial anisotropy fixing the magnetization of the fixed magnetic layer at the intermediate region, the magnetoelastic effect is primarily used in the present invention.
>
> [0030] The magnetoelastic effect is generated by magnetoelastic energy. The magnetoelastic energy is defined by a stress applied to the fixed magnetic layer and the magnetostriction constant at the central portion thereof.
>
> [0031] *In the present invention, since the end surface of the fixed magnetic layer at the face opposing a recording medium is an open end surface, the symmetry of stresses generated, for example, by gap layers which originally have two-dimensional isotropy, is no longer maintained, and as a result, a tensile stress is applied to the fixed magnetic layer in the height direction. In addition, since the first magnetic layer is formed of a magnetic material having a positive magnetostriction constant, by the magnetoelastic effect,* ***the easy axis of magnetization of the first magnetic layer becomes parallel to the direction (height direction) toward the rear side, and the direction of magnetization of the first magnetic layer is fixed parallel or antiparallel to the height direction****.*
>
> [0032] In the present invention, the magnetoelastic energy is increased by increasing the magnetostriction constant of the fixed magnetic layer at the intermediate region, and in accordance with this increase, the uniaxial anisotropy of the fixed magnetic layer at the intermediate region is enhanced. When the uniaxial anisotropy of the fixed magnetic layer at the intermediate region is enhanced, since the magnetization of the fixed magnetic layer at the intermediate region is likely to be tightly fixed in a predetermined direction, the output of the magnetic sensor is increased, and the stability and the symmetry of the output are also improved.
>
> [0033] The entire nonmagnetic metal layer described above or a part thereof in the vicinity of the interface with the first magnetic layer of the fixed magnetic layer may have a face-centered cubic (fcc) structure, and it is preferable that equivalent crystal planes represented by a {111} plane are preferentially oriented in the direction parallel to the interface.

Hasegawa, paragraphs 0025 through 0033 (emphasis added).

These paragraphs of Hasegawa describe the structure of Hasegawa's magnetic sensor. As shown by the emphasized portions, the easy axis of magnetization of the *first magnetic layer* is adjusted, or biased, with respect to the magnetic sensor. However, Hasegawa does not teach that

the *free layer* is biased or adjusted in any way. The lack of disclosure in this regard makes sense in view of the above discussion, because the orientation of the depressions in Hasegawa do not and cannot affect the biasing of the magnetic field of the *free layer*, as provided in claim 1. Thus, this portion of Hasegawa does not teach the claimed feature that "at least one stabilizer depression imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction."

Nevertheless, the examiner also refers to the following portion of Hasegawa for the proposition that Hasegawa has inherent characteristics that read on the features of claim 1:

> [0103] In addition, since the antiferromagnetic layer 20 is not provided on the central portion 17b of the first magnetic layer 17, a sense current from the electrode layer 23 flowing primarily through the nonmagnetic material layer 15 is unlikely to be shunted to the antiferromagnetic layer 20, and hence the shunt loss can be decreased, thereby improving the reproduction output.
>
> [0104] In addition, since the antiferromagnetic layer 20 is not provided on the central portion 17b of the first magnetic layer 17, the distance between the lower shield layer 11 and the upper shield layer 26 is decreased at an element central portion in the thickness direction (Z direction in the figure), and hence so-called narrower gap can be realized. Since the central portion 14b of the free magnetic layer 14 is a region having reproduction sensitivity, when the gap length at the element central portion can be decreased, increase in pulse width (PW50) of a reproduction waveform and decrease in resolution can be appropriately prevented, a magnetic sensor which can appropriately meet the trend toward higher recording density can be manufactured.
>
> [0105] Furthermore, since the antiferromagnetic layer 20 is not provided on the central portion 17b of the first magnetic layer 17, magnetic electrostatic discharge (ESD) becomes unlikely to occur at the element central portion of the fixed magnetic layer 16.
>
> [0106] In a magnetic sensor having an antiferromagnetic layer provided on a fixed magnetic layer, when a transient current flows from an electrode layer by electrostatic discharge (ESD), heat may be generated in the element in some cases so that the temperature is increased to that close to a blocking temperature of the antiferromagnetic layer. In the case described above, when the antiferromagnetic layer generating exchange coupling is present at the central portion of the fixed magnetic layer in the first direction, since the exchange coupling with the fixed magnetic layer at which this antiferromagnetic layer is present becomes unstable, the

> direction of magnetization of the fixed magnetic layer will be moved, and as a result, magnetic electrostatic damage is liable to occur.

Hasegawa, paragraphs 0103 through 0106.

Again, Hasegawa describes the effect of the structure of his magnetic sensor on the magnetic field of the fixed magnetic layer, not on the *free layer* as claimed. Nothing in the above text, or anything else in Hasegawa teaches the claimed feature that "at least one stabilizer depression imparts a restorative force on a magnetic field of the free layer of the magnetoresistive sensor to align the magnetic field with a bias direction," as provided in claim 1. Accordingly, Hasegawa does not have inherent characteristics or similar structures that would read on claim 1. For this reason, Hasegawa does not anticipate claim 1.

Independent claims 3 and 11 as amended contain features similar to those presented in claim 1. For this reason, Hasegawa does not anticipate these claims for the reasons provided above. Similarly, Hasegawa does not anticipate the remaining dependent claims at least by virtue of their dependency on claims 1, 3, or 11. Additionally, claim 3 and the dependent claims have other features not taught or suggested by Hasegawa. For example, Hasegawa does not teach a bottom spin-valve sensor, as claimed in claim 3 and as explained in the previous response to office action, notwithstanding the examiner's response to arguments. The fact that the claim 3 can contain additional layers does not change the fact that Hasegawa does not show a bottom spin valve sensor. A bottom spin valve sensor must have certain layer arranged in a certain orientation with respect to each other. The structure of a bottom spin valve sensor is inherently different than the structure of a top spin valve sensor, regardless of which direction is considered "top" and which direction is considered "bottom." The "broad disclosure" of Hasegawa, as asserted by the examiner, does not show a bottom spin-valve sensor, as claimed, and the examiner has not proved otherwise. Thus, Hasegawa does not anticipate claim 3 at least for this reason, in addition to the other reasons presented above.

Furthermore, *Hasegawa* does not teach, suggest, or give any incentive to make the needed changes to reach the presently claimed invention. Hasegawa actually teaches away from the invention of claim 1 because Hasegawa teaches orienting depressions in a magnetic read head in a manner that does not result in the free layer becoming biased, as claimed. Absent the examiner pointing out some teaching or incentive to implement *Hasegawa* and the inventive features of claim 1, one of ordinary skill in the art would not be led to modify *Hasegawa* et al. to reach the

present invention when the reference is examined as a whole. Absent some teaching, suggestion, or incentive to modify *Hasegawa* in this manner, the presently claimed invention can be reached only through an improper use of hindsight using Applicants' disclosure as a template to make the necessary changes to reach the claimed invention.

Regarding new claims 22-24, these claims contain the feature that "the at least one stabilizer depression is oriented parallel to a long axis of the magnetoresistive sensor and perpendicular to a magnetic media if the magnetic media is read by the magnetoresistive sensor." As shown above, Hasegawa specifically teaches that the stabilizer depression is oriented parallel to any magnetic media. Nothing in Hasegawa teaches or suggests otherwise. Thus, Hasegawa does not teach or suggest the features of claims 22-24 and does not anticipate these claims.

V. <u>35 U.S.C. § 102, Asserted Anticipation by Mao</u>

The examiner rejects claims 1, 8, 11, 13, 18, and 21 as anticipated by Mao et al., <u>Planar Double Spin Valve Read Head</u>, U.S. Patent 6,396,668 (May 28, 2002) (hereinafter "Mao"). This rejection is respectfully traversed.

With respect to claim 1, the examiner asserts that:

> Regarding claims 1 and 11, Mao et al. disclose a MR sensor comprising an antiferromagentic (AFM) layer (*figure 5, element 198A +198B*), a non-magnetic spacer layer (*element 190*), a pinned layer (*element 196A and 196B*) disposed between the AFM layer and the spacer layer, wherein the pinned layer is adjacent to both the AFM layer and the spacer layer (*elements 190, 196A/B, 198A/B*), a free layer (*element 188*) disposed adjacent the spacer layer, a gap layer (*element 200*) disposed under the AFM layer, the spacer layer, the pinned layer and the free layer, a bottom shield layer (i.e. applicants' "permanent magnet layer") (*element 202*) disposed under the AFM layer, the spacer layer, the pinned layer, the free layer and the gap layer, at least one stabilizing depression (*depression between elements 194A/196A/198A and 194B/196B/198B*) formed in at least one of the AFM layer, the spacer layer, the pinned layer, the free layer, and/or the gap layer, wherein the stabilizing depression does not extend into the permanent magnet layer (*the depression between elements 194A/196A/198A and 194B/196B/198B does not extend through to element 202*).

Final office action of December 12, 2005, p. 6 (emphasis in original).

Claim 1 is as described above. For reasons similar to those presented vis-à-vis the rejection of claim 1 under Hasegawa, Mao also does not anticipate claim 1.

The examiner asserts that Figure 5 of Mao shows the claimed features. Figure 5 of Mao is as follows:

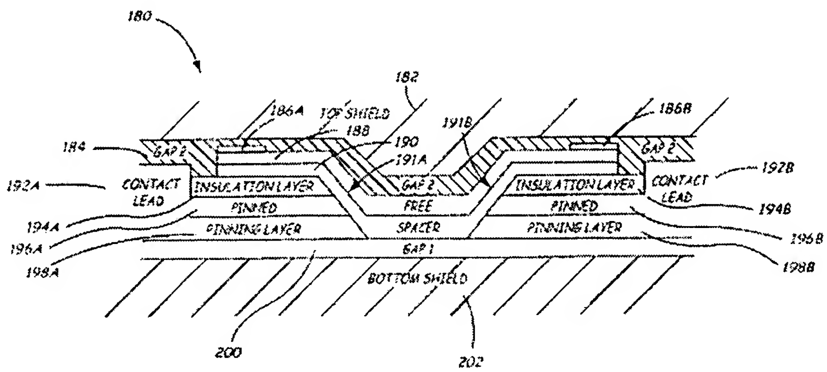

FIG. 5

Like Hasegawa, Mao shows a depression in a magnetic read head. However, also like Hasegawa, the depression in the magnetic read head is oriented parallel to tracks in any magnetic media and perpendicular to the long axis of the magnetic sensor. For example, Mao provides that:

> *Pinning layers 198A-198B, pinned layers 196A-196B and insulation layers 194A-194B are formed on top of first gap layer 200 and milled into the trench shape shown in FIG. 5.* Spacer layer 190 is deposited over insulation layers 194A-194B and over first gap layer 200. A first portion 191A of spacer layer 190 is positioned adjacent and nearly perpendicular to insulation layer 194A, pinned layer 196A and pinning layer 198A. A second portion 191B of spacer layer 190 is positioned adjacent and nearly perpendicular to insulation layer 194B, pinned layer 196B and pinning layer 198B. Free layer 188 is deposited over spacer layer 190. Free layer 188 is preferably made into an elongated shape to take advantage of shape stabilization. With the elongated shape, free layer 188 includes outer regions that overlay pinned layers 196A-196B, rather than the first layer 188 being positioned entirely between layers 196A-196B and 198A-198B. Since pinned layers 196A and 196B are positioned beside free layer 188, rather than above or below free layer 188, there is no demagnetization field from pinned layers 196A and 196B which would adversely affect the bias point and free layer reversal of free layer 188.

Mao, col. 4, ll. 37-57 (emphasis added).

The basic layer structure from which the structure in Figure 5 is derived is shown in Figure 3, which is as follows:

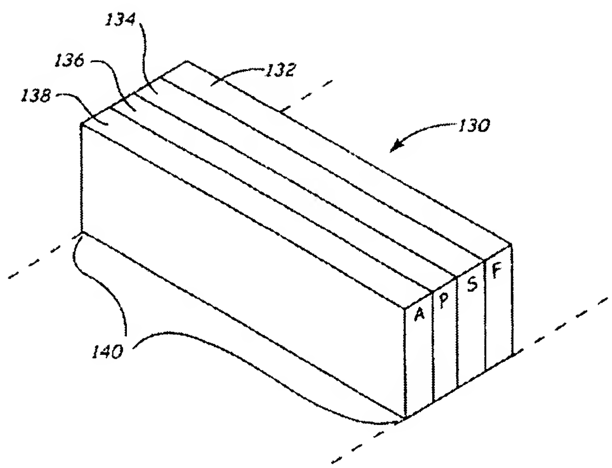

FIG. 3

PRIOR ART

Mao describes the layer structure as follows:

> FIG. 3 is a perspective view of a prior art GMR stack 130. GMR stack 130 has free layer 132, spacer layer 134, pinned layer 136, and antiferromagnetic layer 138. Spacer layer 134 is positioned between free layer 132 and pinned layer 136. *A magnetization of pinned layer 136 is fixed in a predetermined direction, generally normal to air bearing surface 140 of GMR stack 130,* ***while a magnetization of free layer 132 rotates freely in response to an external magnetic field (not shown in FIG. 3)***. Antiferromagnetic layer 138 is positioned on GMR stack 130 such that pinned layer 136 is between spacer layer 134 and antiferromagnetic layer 138. The magnetization of pinned layer 136 is pinned by exchange coupling pinned layer 136 with antiferromagnetic layer 138.

Mao, col. 3. ll. 32-45 (emphasis added).

While Mao claims to improve upon magnetic read heads by forming a double spin-valve sensor, Mao does not change the basic structure of the read head in terms of the orientation of the layers because the magnetization of pinned layer 136 is fixed normal to air bearing surface 140. Thus, the read head shown in Figure 5 shows a typical orientation in which the depression in the magnetic read head is oriented parallel to tracks in any magnetic media and perpendicular to the long axis of the magnetic sensor. Furthermore, Mao specifically states that the magnetic field of free layer rotates freely in response to an external magnetic field. The free layer in Figure 5 of Mao performs the same function.

In contrast, claim 1 provides that "the at least one stabilizer depression imparts a

restorative force on a magnetic field of the *free* layer of the magnetoresistive sensor to align the magnetic field with a bias direction." Mao clearly teaches that the free layer is free to rotate; hence, no restorative force is present on the magnetic field of the free reason. For this reason, Mao contains no structures that could inherently have characteristics that read on the features of claim 1. Additionally, Mao does not show all of the structures required by claim 1. Therefore, Mao does not anticipate claim 1.

Claim 11 contains features similar to those presented in claim 1. Therefore, Mao does not anticipate claim 11 for the reasons presented above. Claims 8, 13, 18, and 21 all depend from claims 1 or 11. Therefore, Mao does not anticipate these claims at least by virtue of their dependency on claims 1 or 11.

Furthermore, *Mao* does not teach, suggest, or give any incentive to make the needed changes to reach the presently claimed invention. Mao actually teaches away from the invention of claim 1 because Mao teaches orienting depressions in a magnetic read head in a manner that does not result in the free layer becoming biased, as claimed. Instead, Mao specifically provides that the magnetic field of the free layer is allowed to rotate. Absent the examiner pointing out some teaching or incentive to implement *Mao* and the inventive features of claim 1, one of ordinary skill in the art would not be led to modify *Mao* et al. to reach the present invention when the reference is examined as a whole. Absent some teaching, suggestion, or incentive to modify *Mao* in this manner, the presently claimed invention can be reached only through an improper use of hindsight using Applicants' disclosure as a template to make the necessary changes to reach the claimed invention.

VI. <u>35 U.S.C. § 102, Asserted Anticipation by Hasegawa '455</u>

The examiner rejects claims 1, 2, 8, 11-13, 18, and 21 as anticipated by *Hasegawa* et al., <u>Magnetic Sensing Element Biased by Two Antiferromagnetic Layers Above Free Magnetic Layer and Two Hard Bias Layers at Two Sides of the Free Magnetic Layer, and Method for Making the Same</u>, U.S. Patent Application Publication 2004/0008455, January 15, 2004 (hereinafter "*Hasegawa '455*"). This rejection is respectfully traversed.

Applicants first address the rejection of claim 1. Regarding claim 1, the examiner states that:

> Regarding claims 1 and 111, Hasegawa et al. ('455 A1) disclose a MR sensor comprising an antiferromatic (AFM) layer (*Figure 6, element 12*), a non-magnetic spacer layer (*element 14*), a pinned layer (*element 13*) disposed between the AFM layer and the spacer layer, wherein the pinned layer is adjacent to both the AFM layer and the spacer layer (*elements 12, 13, 14*), a free layer (*element 15*) disposed adjacent the spacer layer, a gap layer (*element 32*) disposed under the AFM layer, the spacer layer, the pinned layer and the free layer, a bottom shield layer (i.e. applicants' "permanent magnet layer") (*element 31*) disposed under the AFM layer, the spacer layer, the pinned layer, the free layer and the gap layer, at least one stabilizing depression (*depression in elements 12, 13, 14, and 15*) formed in at least one of the AFM layer, the spacer layer, the pinned layer, the free layer, and/or the gap layer, wherein the stabilizing depression deos not extend into the permanent magnet layer (*the depression in elements 12, 13, 14 and 15 does not extend through to element 31*).

Final office action of December 12, 2004, p. 7 (emphasis in original).

Claim 1 is as described above. For reasons similar to those presented vis-à-vis the rejection of claim 1 under Hasegawa, Hasegawa '455 also does not anticipate claim 1.

The examiner refers to Figure 6 of Hasegawa '455 in support of the rejection. Figure 6 of Hasegawa '455 is as follows:

FIG. 6

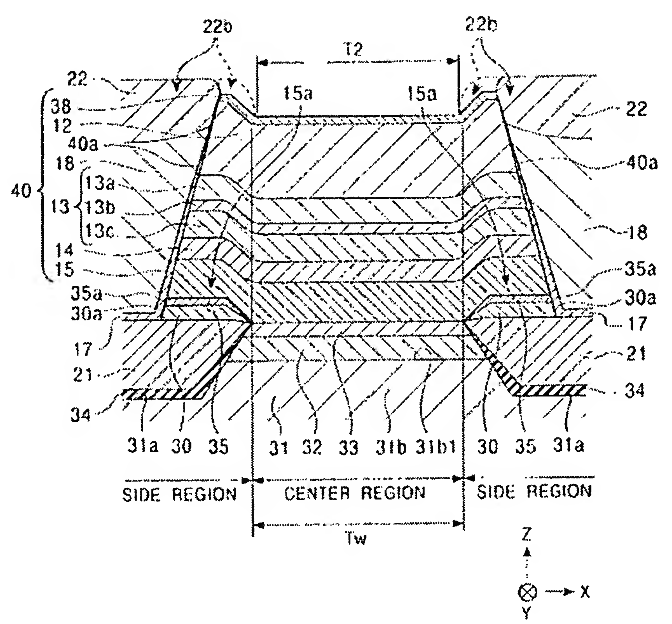

Figure 6 of Hasegawa '455 clearly shows that the depression lies parallel to the track of any magnetic media, as indicated by the letters "Tw" in the center region of the magnetic read head.

Thus, for the reasons described vis-à-vis the rejection in view of Hasegawa, the depression shown in Hasegawa '455 in does not and cannot affect the orientation of the magnetic field of the *free* layer, as provided in claim 1. Like the magnetic sensor shown in both Hasegawa and Mao, the magnetic field of the free layer must be able to rotate freely, and not have a bias as in the claimed invention. For this reason, the depression shown in Hasegawa '455 affects the magnetic field of the *pinning* layer and does not affect the free layer.

In contrast, claim 1 requires that "the at least one stabilizer depression imparts a restorative force on a magnetic field of the *free* layer of the magnetoresistive sensor to align the magnetic field with a bias direction." Hasegawa '455 does not show any structures having characteristics that would read upon this claimed feature. Accordingly, Hasegawa '455 does not anticipate claim 1.

Claims 3 and 11 contains features similar to those presented in claim 1. Therefore, Hasegawa '455 does not anticipate claims 3 or 11 for the reasons presented above. Claims 2, 8, 12, 13, 18, and 21 all depend from claims 1, 3, or 11. Therefore, Hasegawa '455 does not anticipate these claims at least by virtue of their dependency on claims 1, 3, or 11.

Furthermore, Hasegawa '455 does not teach, suggest, or give any incentive to make the needed changes to reach the presently claimed invention. Hasegawa '455 actually teaches away from the invention of claim 1 because Hasegawa '455 teaches orienting depressions in a magnetic read head in a manner that does not result in the free layer becoming biased, as claimed. Instead, Hasegawa '455 specifically provides for a magnetic read head structure that allows the magnetic field of the free layer to rotate. Absent the examiner pointing out some teaching or incentive to implement Hasegawa '455 and the inventive features of claim 1, one of ordinary skill in the art would not be led to modify Hasegawa '455 et al. to reach the present invention when the reference is examined as a whole. Absent some teaching, suggestion, or incentive to modify Hasegawa '455 in this manner, the presently claimed invention can be reached only through an improper use of hindsight using Applicants' disclosure as a template to make the necessary changes to reach the claimed invention.

VII. 35 U.S.C. § 102, Asserted Anticipation by Min

The examiner rejects claims 1, 2, 6-12 and 16-18 as anticipated by *Min* et al., Method of Forming a Continuous Free Layer Spin Valve Sensor with Patterned Exchange Underlayer

<u>Stabilization</u>, U.S. Patent 6,606,782, August 19, 2003 (hereinafter "*Min*"). This rejection is respectfully traversed.

As to claims 1, 2, 6-12 and 16-18, the examiner states:

> Regarding claims 1 and 11, *Min* et al. disclose a MR sensor (Title) comprising a plurality of sensor stack layers (Figure 5E); and at least one depression (i.e. applicants' "stabilizer depression") formed in one sensor stack layer within the plurality of sensor stack layers (Figure 5E, area marked as 7W).
>
> The limitation "wherein the at least one stabilizer depression imparts a restorative force on a magnetic field of a free layer of the magnetoresistive sensor to align the magnetic field with a bias direction" is a functional limitation(s). As defined in the MPEP, "[a] functional limitation is an attempt to define something by what it does, rather than by what it is (e.g., as evidenced by its specific structure or specific ingredients). There is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper. In re Swinehart, 439 F.2d 210, 169 USPQ 226 (CCPA 1971)"— MPEP § 2 173.05(g). However, the examiner notes that "where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on" (emphasis added) - MPEP § 2183.
>
> In the instant case, the claimed limitation(s) "wherein the at least one stabilizer depression ... with a bias direction" is a functional limitation(s) and is deemed to be an inherent characteristic of the prior art since the prior art is substantially identical in composition and/or structure. The examiner's sound basis for this assertion is the comparison of the layer and structure order in applicants' Figures 7 and 8 to *Min* et al. Figure 5E.

Office action of July 5, 2005, pp. 5-6.

The examiner withdrew the rejection of the claims over Min in the final office action of December 12, 2005. However, in view of the amendments returning the claims to a form similar to the claims as filed, Applicants again address the rejections over Min.

Applicants first address the rejection of claim 1. Claim 1 is as described above. For reasons similar to those presented vis-à-vis the rejection of claim 1 under Hasegawa, Min also does not anticipate claim 1.

The examiner asserts that the structure shown in Figures 7 and 8 of Min have characteristics that inherently read on the features of claim 1. The examiner specifically asserts

that Min shows an identical structure and thus must show the claimed feature that "the at least one stabilizer depression imparts a restorative force on a magnetic field of the *free* layer of the magnetoresistive sensor to align the magnetic field with a bias direction."

However, the examiner is mistaken in that the structures shown in Min are identical to those claimed. The examiner is also mistaken that the structures shown in Min inherently impart a restorative force on the magnetic field of the free layer, as claimed. Nevertheless, the examiner refers to Figures 5E, 7, and 8 of Min and the depression shown in those figures for the proposition that Min does inherently have characteristics that read on the claimed features. Figure 5E of Min is as follows:

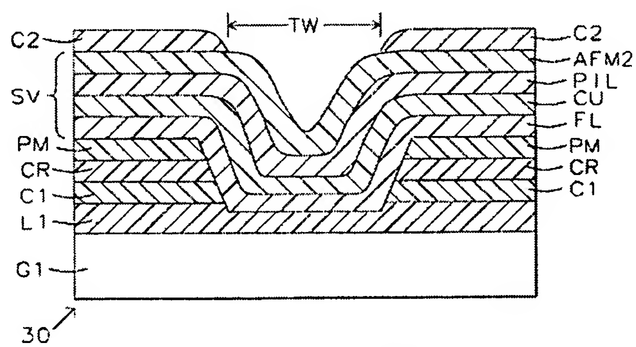

FIG. 5E

As designated by the letters "TW," Min shows that the depression defines the track width of the magnetic sensor. In other words, the depression is parallel to the magnetic media in Min. Thus, for the reasons described vis-à-vis the rejection in view of Hasegawa, the depression shown in Min does not and cannot affect the orientation of the magnetic field of the *free* layer, as provided in claim 1. Like the magnetic sensor shown in both Hasegawa and Mao, the magnetic field of the free layer must be able to rotate freely, and not have a bias as in the claimed invention. For this reason, the depression affects the magnetic field of the *pinning* layer and does not affect the free layer.

In contrast, claim 1 requires that "the at least one stabilizer depression imparts a restorative force on a magnetic field of the *free* layer of the magnetoresistive sensor to align the magnetic field with a bias direction." Min does not show any structures having characteristics that would read upon this claimed feature. Accordingly, Min does not anticipate claim 1.

Claims 3 and 11 contains features similar to those presented in claim 1. Therefore, Min does not anticipate claims 3 or 11 for the reasons presented above. Claims 2, 6-10, 12, and 16-18

all depend from claims 1, 3, or 11. Accordingly, Min does not anticipate these claims at least by virtue of their dependency on claims 1, 3, or 11.

Furthermore, *Min* does not teach, suggest, or give any incentive to make the needed changes to reach the presently claimed invention. Min actually teaches away from the invention of claim 1 because Min teaches orienting depressions in a magnetic read head in a manner that does not result in the free layer becoming biased, as claimed. Instead, Min specifically provides for a magnetic read head structure that allows the magnetic field of the free layer to rotate. Absent the examiner pointing out some teaching or incentive to implement *Min* and the inventive features of claim 1, one of ordinary skill in the art would not be led to modify *Min* et al. to reach the present invention when the reference is examined as a whole. Absent some teaching, suggestion, or incentive to modify *Min* in this manner, the presently claimed invention can be reached only through an improper use of hindsight using Applicants' disclosure as a template to make the necessary changes to reach the claimed invention.

VIII. <u>35 U.S.C. § 103, Asserted Obviousness</u>

The examiner rejects claims 2 and 12 as obvious over Hasegawa '455. The examiner states that:

> While the Examiner maintains that Hasegawa et al. ('455 A1) provides sufficient information to anticipate claims 2 and 12 for the reasons cited above, the Examiner acknowledges that Hasegawa et al. ('455 A1) fail to explicitly disclose such an embodiment in a figure.
>
> However, since Hasegawa et al. ('455 A1) teach that top spin valve sensors meeting applicants' claimed structural limitations and bottom spin valve sensors meeting applicants' claimed structural limitations are known equivalent spin valve sensor structures (*e.g. claims 1 and 10 of Hasegawa et al. '455 A1)*, the Examiner deems that modification of the structure of Figure 6 to reverse the order of layers 12-15 would have been an obvious variant within the knowledge of one of ordinary skill.
>
> It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant(s0 invention to modify the device of Hasegawa et al. ('455 A1) to produce a top spin valve sensor meeting applicants' claimed limitations, since such a structure would be accomplished by the taught reversing layers 12-15, which is a known equivalent structure to that disclosed in Figure 6.

Final office action of December 12, 2005, pp. 8-9 (emphasis in original).

If the Patent Office does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of a patent. *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Grabiak*, 769 F.2d 729, 733, 226 U.S.P.Q. 870, 873 (Fed. Cir. 1985). A prima facie case of obviousness is established when the teachings of the prior art itself suggest the claimed subject matter to a person of ordinary skill in the art. *In re Bell*, 991 F.2d 781, 783, 26 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1993). All limitations of the claimed invention must be considered when determining patentability. *In re Lowry*, 32 F.3d 1579, 1582, 32 U.S.P.Q.2d 1031, 1034 (Fed. Cir. 1994).

Claims 2 and 12 depend from claims 1 and 11, respectively. Therefore, Hasegawa '455 does not teach the features of claims 2 and 12 at least by virtue of their dependency on claims 1 and 11. Additionally, as described above, Hasegawa '455 does not provide any suggestion that a depression be oriented so as to affect the *free* layer. To the contrary, Hasegawa '455 teaches away from the claimed feature that "the at least one stabilizer depression imparts a restorative force on a magnetic field of the *free* layer of the magnetoresistive sensor to align the magnetic field with a bias direction" because the magnetic sensor shown in Hasegawa '455 requires that the magnetic field of the free layer be allowed to rotate.

For these reasons, Hasegawa '455 does not teach or suggest all of the features of claims 2 and 12. Accordingly, the proposed modification or reading of Hasegawa '455 does not result in the inventions of claims 2 and 12 and the examiner has failed to state a prima facie obviousness rejection of these claims.

Similarly, in view of the fact that Hasegawa '455 teaches away from the features of claims 2 and 12, one of ordinary skill would have no reason to modify Hasegawa '455 or to combine Hasegawa '455 with another reference to achieve the inventions of claims 2 and 12. For this reason, no motivation, teaching, or suggestion exists to modify Hasegawa '455 or to combine Hasegawa '455 with some other reference to achieve the inventions of claims 2 and 12. Accordingly, the examiner has again failed to state a prima facie obviousness rejection of these claims.

IX. Conclusion

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

DATE: March 13, 2006

Respectfully submitted,

Fay

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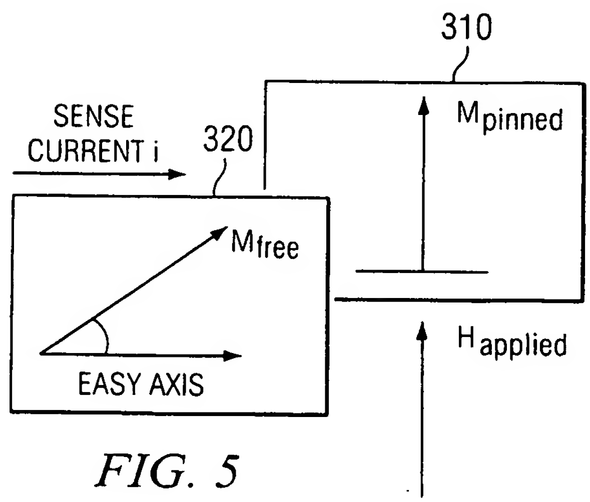
310
SENSE CURRENT i
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M_{pinned}
M_{free}
EASY AXIS
$H_{applied}$

FIG. 5

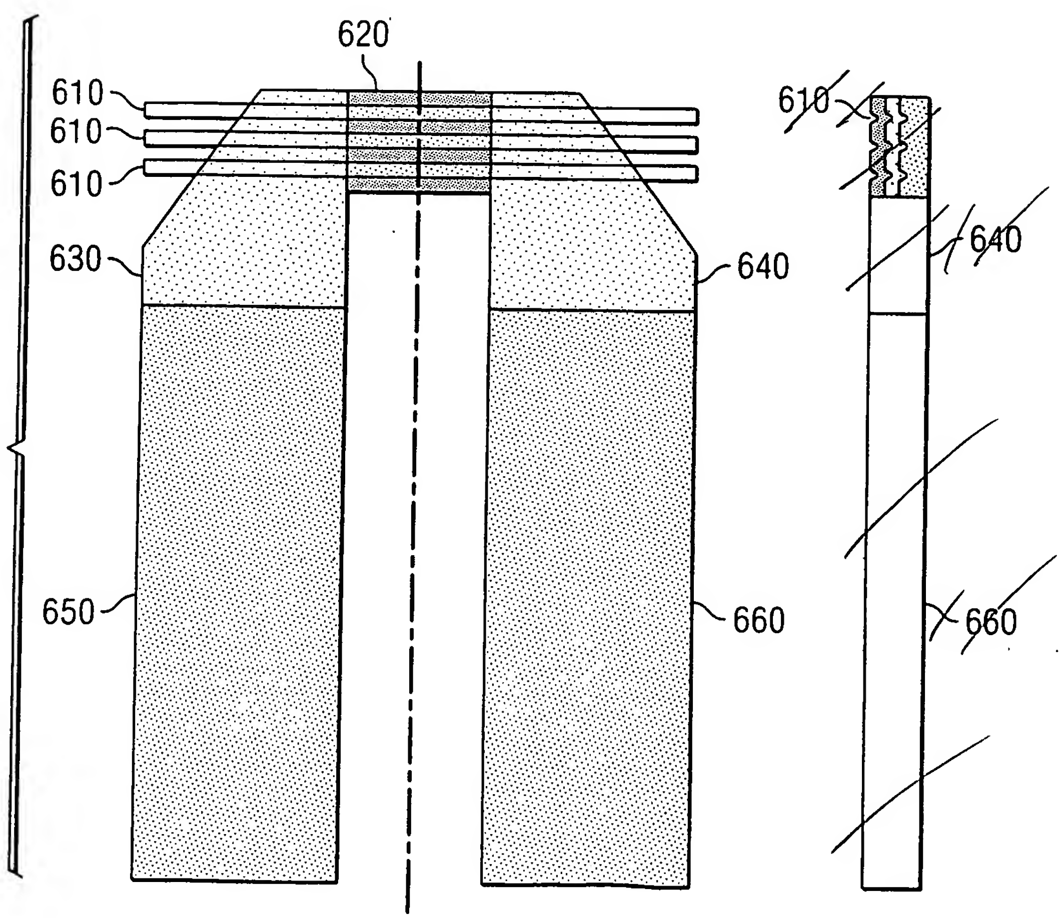
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FIG. 6